

CLAIMS

What is claimed is:

1 1. A circuit for providing current to a plurality of LEDs, the circuit comprising:
2 a plurality of current regulators, each current regulator operable to control current
3 in a respective one of the LEDs;
4 a charge pump terminal operable to supply current to the plurality of LEDs;
5 a voltage regulator operable to supply energy to the charge pump; and
6 a detector operable to detect occurrence of a condition selected from a list
7 consisting of current starvation and incipient current starvation at any of the current
8 regulators;

9 wherein the voltage regulator has an output that is responsive to detection of the
10 condition of current starvation.

1 2. The circuit of claim 1 wherein the charge pump has at least two operating modes,
2 each operating mode having a respective voltage gain, and wherein one of the at least two
3 operating modes is selected in response to detection of the condition.

1 3. The circuit of claim 1 wherein the detector comprises a wired-OR circuit
2 arrangement.

1 4. The circuit of claim 1 wherein the detector comprises bipolar diodes and the
2 plurality of current regulators comprises field effect transistors.

1 5. The circuit of claim 4 wherein the detector receives a bandgap reference voltage
2 and further comprises a temperature compensating diode and a comparator.

1 6. The circuit of claim 2 further comprising a mode latch operable to control
2 selection of an active operating mode from the at least two operating modes.

7. The circuit of claim 6 wherein the charge pump has at least three operating
modes.

1 8. The circuit of claim 1 wherein the current regulators carry independently differing
2 currents.

1 9. A circuit for providing current to a plurality of LEDs, the circuit comprising:
2 means for regulating current in each of the LEDs;
3 means for supplying current to the plurality of LEDs;

4 means for regulating the means for supplying current; and
5 means for detecting occurrence of a condition selected from a list consisting of
6 current starvation and incipient current starvation at the means for regulating current;
7 wherein the regulating is responsive to the detecting.

1 10. The circuit of claim 9 wherein the means for regulating comprises a charge pump,
2 the charge pump having multiple modes, each mode having a respective voltage gain.

1 11. The circuit of claim 9 wherein the means for regulating comprises a linear voltage
2 regulator.

1 12. The circuit of claim 9 wherein the means for detecting comprises a wired-OR of
2 bipolar diodes and the means for limiting current comprises a field effect transistor.

1 13. A method for providing current to a plurality of LEDs comprising:
2 regulating current in each of the LEDs to not exceed a desired amount;
3 detecting a condition selected from a list consisting of current starvation and
4 incipient current starvation in any of the LEDs; and
5 regulating a voltage supplied to the plurality of LEDs in response to the detecting
6 so that the current starvation is abated.

1 14. The method of claim 13 wherein the regulating of a voltage is performed using a
2 multi-mode charge pump.

1 15. The method of claim 14 wherein the regulating of a voltage is further performed
2 using a linear voltage regulator.